Patent claims

1.
A subsea gas compressor module having a pressure housing (3) which comprises:
an electric motor (1) and a compressor (2), drivably connected by at least one shaft (13); said compressor and motor being mutually isolated by at least one seal (14), thereby dividing said pressure housing (3) into a first and a second compartment comprising the compressor and motor, respectively;
characterized in that
said at least one shaft is supported by magnetic bearings (12) controlled by a control unit (16), said control unit being placed externally of said pressure housing, and connected to said magnetic bearings by means of wire connections or subsea mateable connectors.

2.
The gas compressor module of claim 1,
characterized in that
said pressure housing is oriented vertically.

3.
The gas compressor module of claim 1,
characterized in that
said motor is placed above said compressor, wherein said second compartment is located above said first compartment.

4.
A subsea gas compressor module having a pressure housing (3) comprising a sealing element (14), generally defining within said pressure housing a first compartment holding a compressor (2) and a second compartment holding an electric motor (1), said compressor and motor being drivably connected by at least one shaft (13); said first compartment being connected to an inlet line (11) and an outlet line for receiving gas and discharging gas, respectively; said inlet and outlet lines comprising respective valves (7, 9) for closing said lines, characterized by
- said first compartment being subdivided into a third compartment by means of another sealing element (15), comprising another bearing (12);
- magnetic bearings (12) in said second compartment and magnetic bearings (12') in the first compartment for supporting said at least one shaft;

- a pressure and volume regulator (4) fluidly connected to said second compartment and to a supply (10) of gas and comprising means for sensing respective pressures in said inlet and outlet lines; whereby, based on the magnitude of said sensed pressure, the pressure and volume regulator controls the pressure at which gas from said supply is injected into said second compartment.

5.
The gas compressor module of claim 4,
c h a r a c t e r i z e d i n t h a t
said pressure and volume regulator also is connected to said third compartment, whereby, based on the magnitude of said sensed pressure, the pressure and volume regulator controls the pressure at which gas from said supply is injected into said third compartment.

6.
The gas compressor module of claim 4,
c h a r a c t e r i z e d i n t h a t
said sealing elements (14, 15) are shaft seals associated with said shaft (13).

7.
The gas compressor module of claims 4 – 6,
c h a r a c t e r i z e d i n t h a t
said gas supply (10) is an inert gas supply, whereby inert gas is injected into said second compartment.

8.
The gas compressor module of claims 4 – 6,
c h a r a c t e r i z e d i n t h a t
said gas supply is a well stream, and hydrocarbon gas is extracted from the compressor outlet or an intermediate stage, passed through a heat exchanger (60), a choke valve (70), a scrubber (80), whereby dried hydrocarbon gas is injected into said second compartment.

9.

The gas compressor module of claims 4 – 6,

c h a r a c t e r i z e d i n t h a t

the hydrocarbon gas extracted from the compressor outlet or an intermediate stage is mixed with a fraction of inert gas, in order to keep the dew point below that of the cooling medium.

10.

The gas compressor module of claim 4,

c h a r a c t e r i z e d i n t h a t

said fluid is composed of a mix of inert gas and hydrocarbon gas, with a proportion of inert gas to make the dew point of the mix suitable to avoid condensation, preferably below sea water temperature at all modes of operation or shut-down.

11.

A method for controlling the pressure in a subsea compressor module according to claims 1 or 4, comprising:

a) compressing a well stream gas being fed at a suction pressure (p_s) into said compressor (2) in said first compartment;

b) discharging said gas from the first compartment at a discharge pressure (p_d)

c h a r a c t e r i z e d b y

c) sensing (4, 5, 6) said suction and discharge pressures

d) injecting a dry or inert (extraneous) gas from a supply (10; 11) into said second compartment at an injection pressure (p_1),

wherein said injection pressure is greater than said suction pressure and whereby fluid flow directly from said first compartment and into said second compartment is prevented.

12.

A method for controlling the pressure in a subsea compressor module according to claims 1 or 4, when said compressor (2) is inactive and valves 7 and 9 are closed,

c h a r a c t e r i z e d b y

a) sensing (4, 5, 6) a suction pressure (p_s) upstream of said first compartment;

b) sensing (4, 5, 6) a discharge pressure (p_d) downstream of said first compartment;

c) injecting a dry or inert gas from a supply (10; 11) into said second compartment at an injection pressure (p_1),

wherein said injection pressure is greater than said suction pressure and said discharge pressure, and whereby fluid flow directly from said first compartment and into said second compartment is prevented and ingress of wet gas and liquids from the natural gas line 11 into the compressor module 3 is also prevented .

13.

The method of either claims 11 or claim 12,

c h a r a c t e r i z e d i n t h a t

said dry or inert gas is injected at an injection pressure into a third compartment defined by a sealing element (15).

14.

The method of either claims 11 or claim 12,

c h a r a c t e r i z e d i n t h a t

said gas supply (10) is an inert gas supply, whereby inert gas is injected into said second compartment.

15.

The method of either claims 11 or claim 12,

c h a r a c t e r i z e d i n t h a t

said gas supply (11) is a well stream, and hydrocarbon gas is extracted from the compressor outlet or an intermediate stage, passed through a heat exchanger (60), a choke valve (70), a scrubber (80), whereby dried hydrocarbon gas is injected into said second compartment.